THE ROLE OF AGRICULTURAL PRACTICES IN FUGITIVE DUST EMISSIONS

Contract Term: July 9, 1979 to April 9, 1981

Progress Report for the Period
January 1 through January 31, 1980

Prepared for

California Air Resources Board
1102 Q Street
P.O. Box 2815
Sacramento, California 95812

Under Contract No. A8-125-31
MRI Project No. 4809-L
Progress Report No. 6
Date Prepared: February 20, 1980

By

Midwest Research Institute
425 Volker Boulevard
Kansas City, Missouri 64110

PREFACE

This report was prepared for the California Air Resources Board (Mr. Robert Grant, Project Officer) to summarize work performed during the last reporting period and to describe the current status of the project being carried out under Contract No. A8-125-31. This work was performed in the Air Quality Assessment Section of the Environmental Systems Department. This report was written by Mr. Thomas Cuscino, Project Leader.

Approved for:

MIDWEST RESEARCH INSTITUTE

M. P. Schrag, Director
Environmental Systems Department

February 20, 1980

The statements and conclusions in this report are those of the Contractor and not necessarily those of the State Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such product.

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1.0 INTRODUCTION

The objective of this report is to describe the progress, direction, and expense during the reporting period for the project entitled, "The Role of Agricultural Practices in Fugitive Dust Emissions." Progress will be measured by specific accomplishments, direction will be measured by specific proposed subtasks, and expense will be measured by monthly and cumulative expenditure of dollars and hours.

In an effort to maintain the originally planned course for the project, the project objectives are listed to provide the standard with which the past and proposed work is to be compared:

a. Identify those agricultural operations likely to produce large quantities of fugitive dust emissions.

b. Quantify the emissions from these operations in terms of total particles and by size range.

c. Evaluate the effects of changes in soil moisture and other factors on fugitive dust emissions and the influence of wind velocity on dust levels and on visibility at varying distances downwind of the source.

d. Define the costs and benefits of potential changes in agricultural practices or equipment which would reduce inhalable particulate levels and would improve visibility.

This report contains the following information:

a. A discussion of the progress during the reporting period;

b. A cost summary for the reporting period;

c. A cumulative cost and hours expended summary; and

d. Proposed work during the next reporting period.

There are two companies with the same acronym which will be referred to in this report: Midwest Research Institute and Meteorology Research, Inc. To avoid confusion, MRI will always refer to Midwest Research Institute, while Meteorology Research, Inc. will always be spelled out.

2.0 PROGRESS DESCRIPTIONS

This section describes the work accomplished during the reporting period. Based on KVB's Task I report, a graphical representation of the acres of crops harvested in California in 1978 was prepared. Authorization was given to KVB to proceed with Task II. Finally, the available data on surface moisture of California soils were analyzed and a preliminary approach formulated for determining surface moisture as a function of time and location.

2.1 TASK 1: SURVEY AGRICULTURAL OPERATIONS AND EQUIPMENT

Using KVB's Task 1 report, graphs were prepared showing the acreage of crops by valley (San Joaquin, Sacramento, and Imperial) and by generic crop type (field and seed crops, vegetables, and fruit and nut crops). The graphs are presented in Figures 1 through 9. One obvious conclusion is that the acreage of field crops far surpasses other generic crop categories in California.

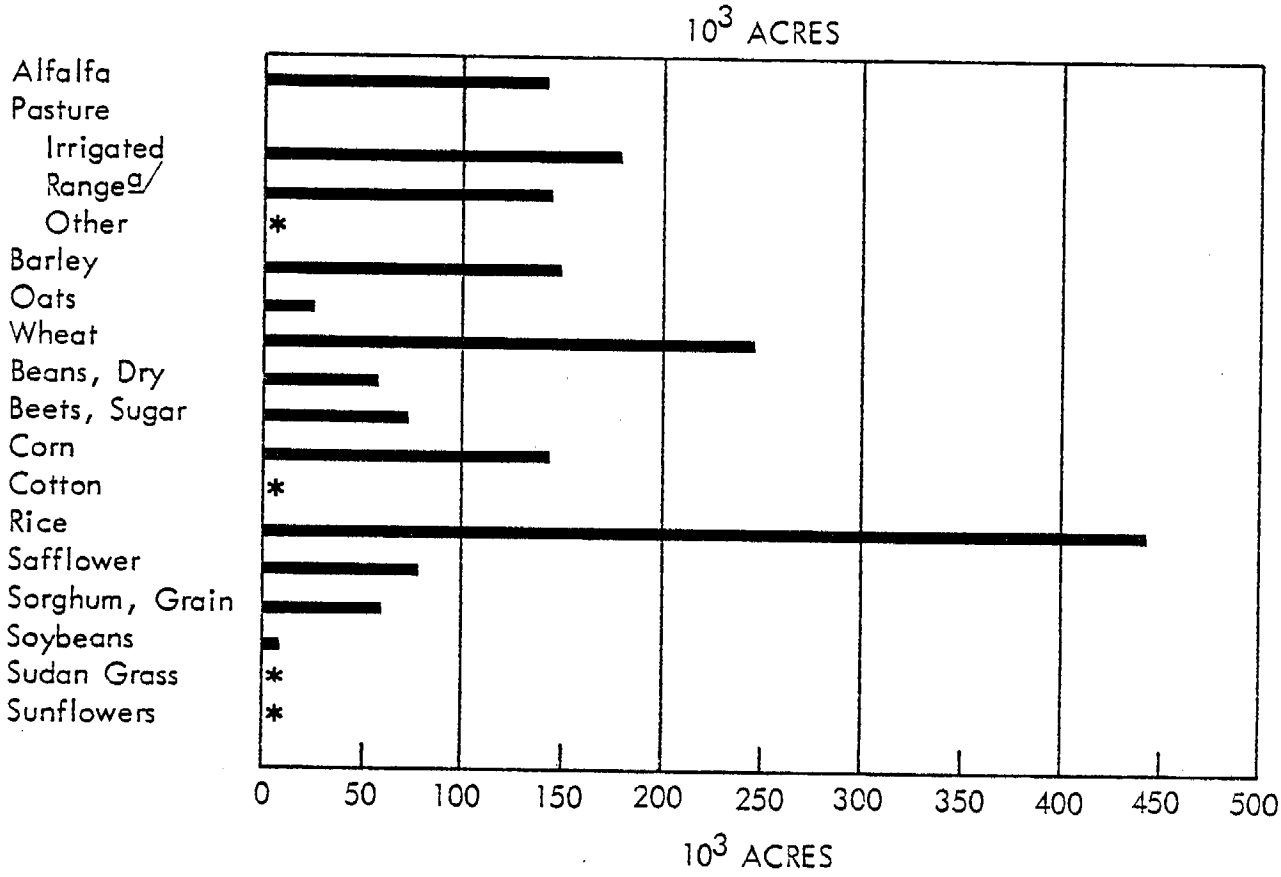
2.2 TASK 2: MEASURE EMISSIONS AND PARTICLE SIZE DISTRIBUTION

Work on Task 2 was initiated with an authorization to KVB to begin work on this task as per the subcontract agreement. A copy of the letter of authorization is contained in the Appendix.

2.3 TASK 3: EVALUATE INFLUENCING FACTORS AND AIR QUALITY IMPACTS

After further contact with Dr. Jerry Hatfield at the University of California at Davis, it was ascertained that he has published no further work on surface soil moisture contents. Consequently, Dr. Hatfield's work,[1] along with the work of Idso, Jackson, and Reginato[2-7] will have to serve as the temporary data base from which tentative conclusions are drawn.

As a rough, first approach, the predictive relationships for moisture as a function of soil surface temperature suggested in the above references will be applied in the counties of interest. Monthly soil temperatures will be acquired from published Climatological Data. Then, monthly soil moistures will be calculated.



* = Negligible

a/ Acreage is 10% of total range pasture land since only 10% of such land requires land preparation in each year.

Figure 1. 1978 Acreage of harvested field and seed crops in the Sacramento Valley.

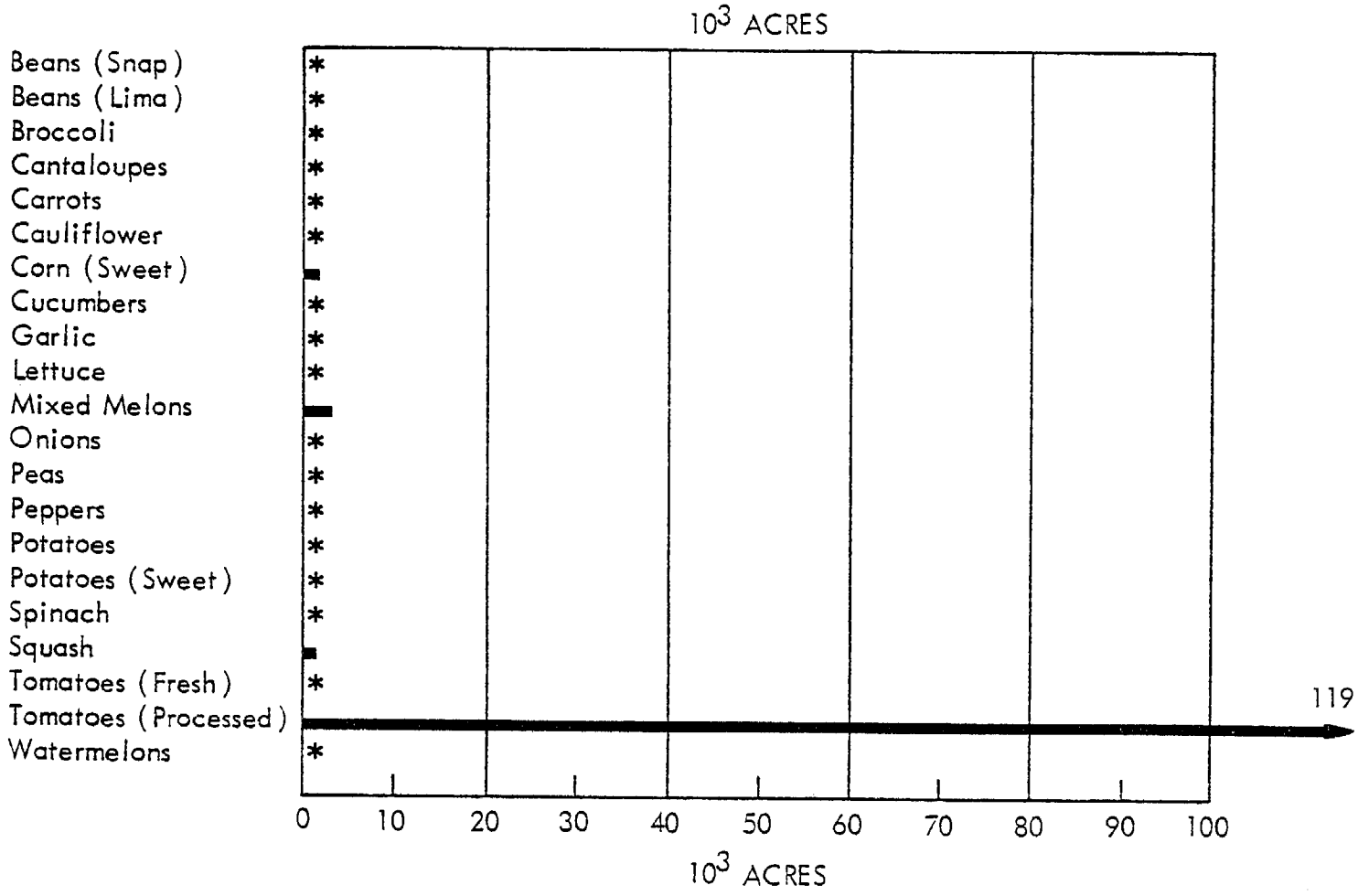


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Figure 2. 1978 Acreage of harvested vegetables in the Sacramento Valley.

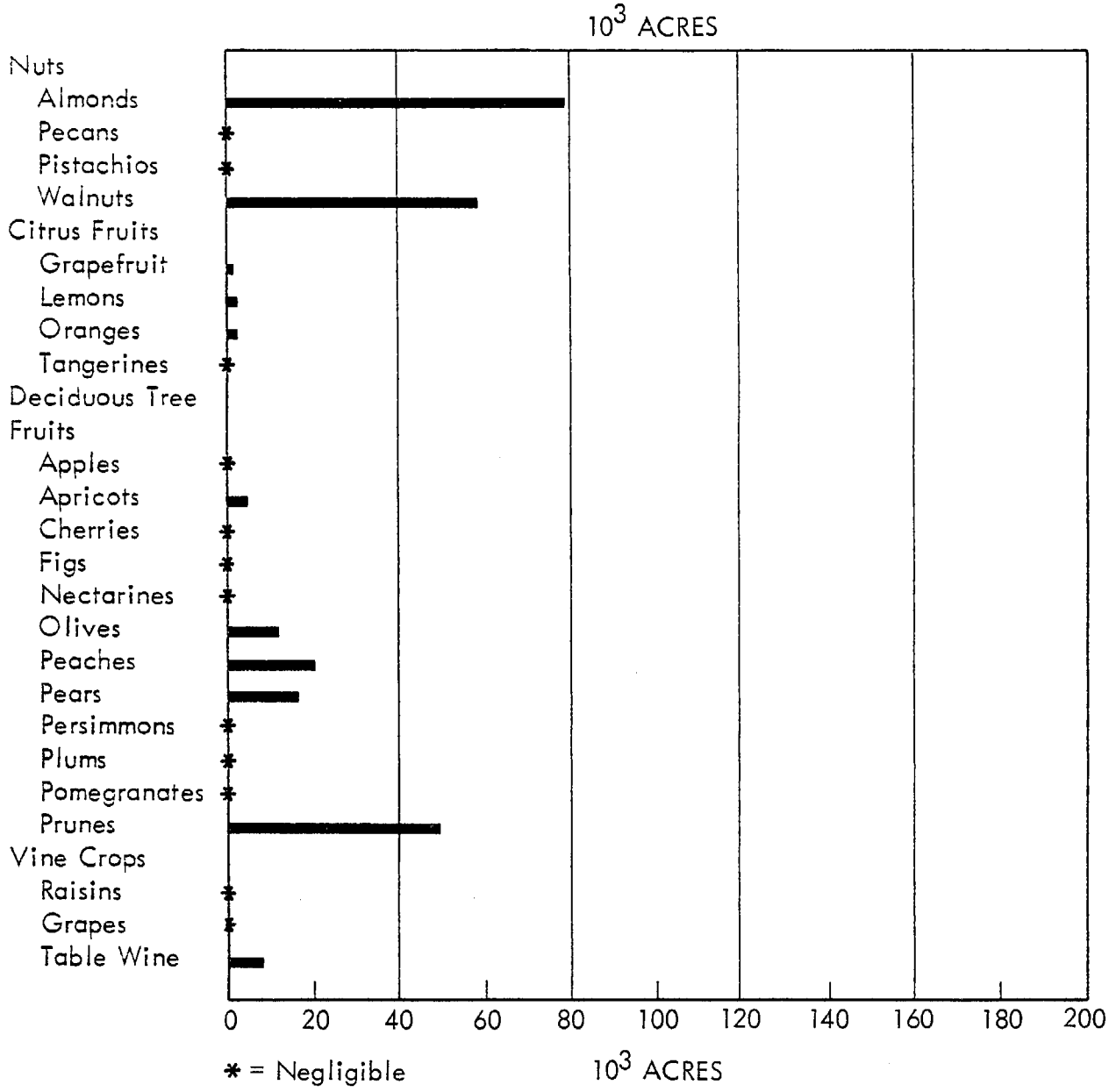
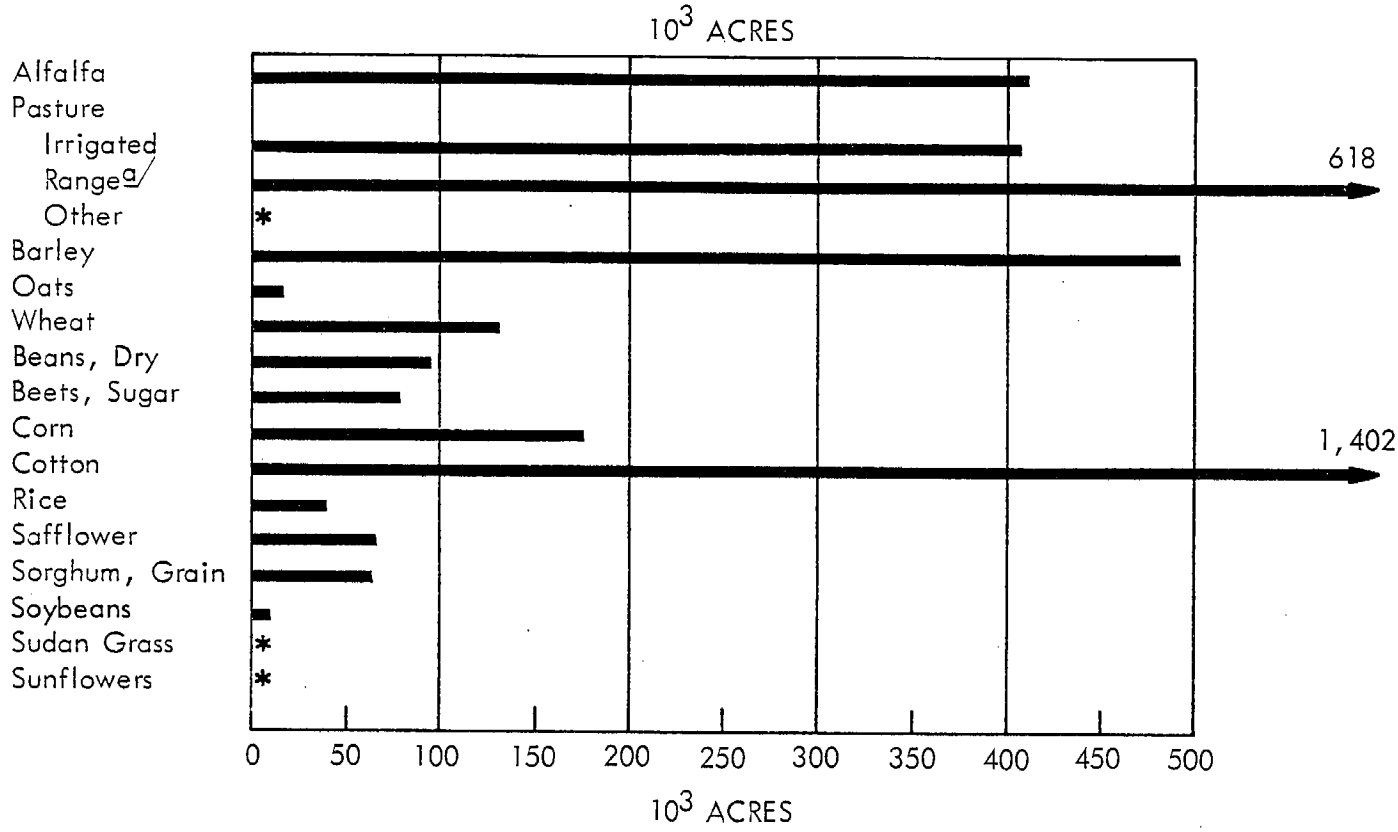


Figure 3. 1978 Acreage of harvested fruit and nut crops in the Sacramento Valley.



* = Negligible

a/ Acreage is 10% of total range pasture land since only 10% of such land requires land preparation in each year.

Figure 4. 1978 Acreage of harvested field and seed crops in the San Joaquin Valley.

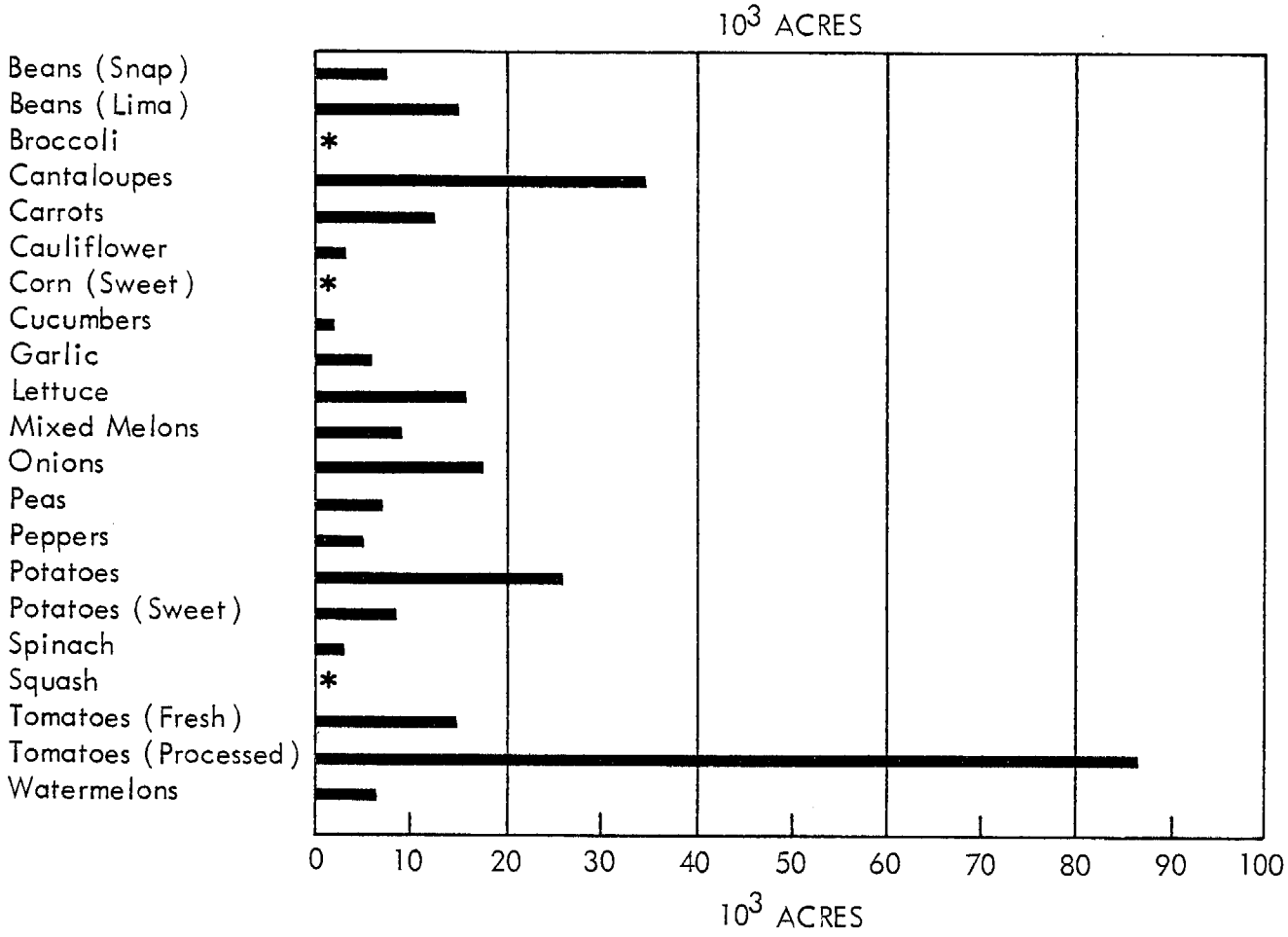


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Figure 5. 1978 Acreage of harvested vegetables in the San Joaquin Valley.

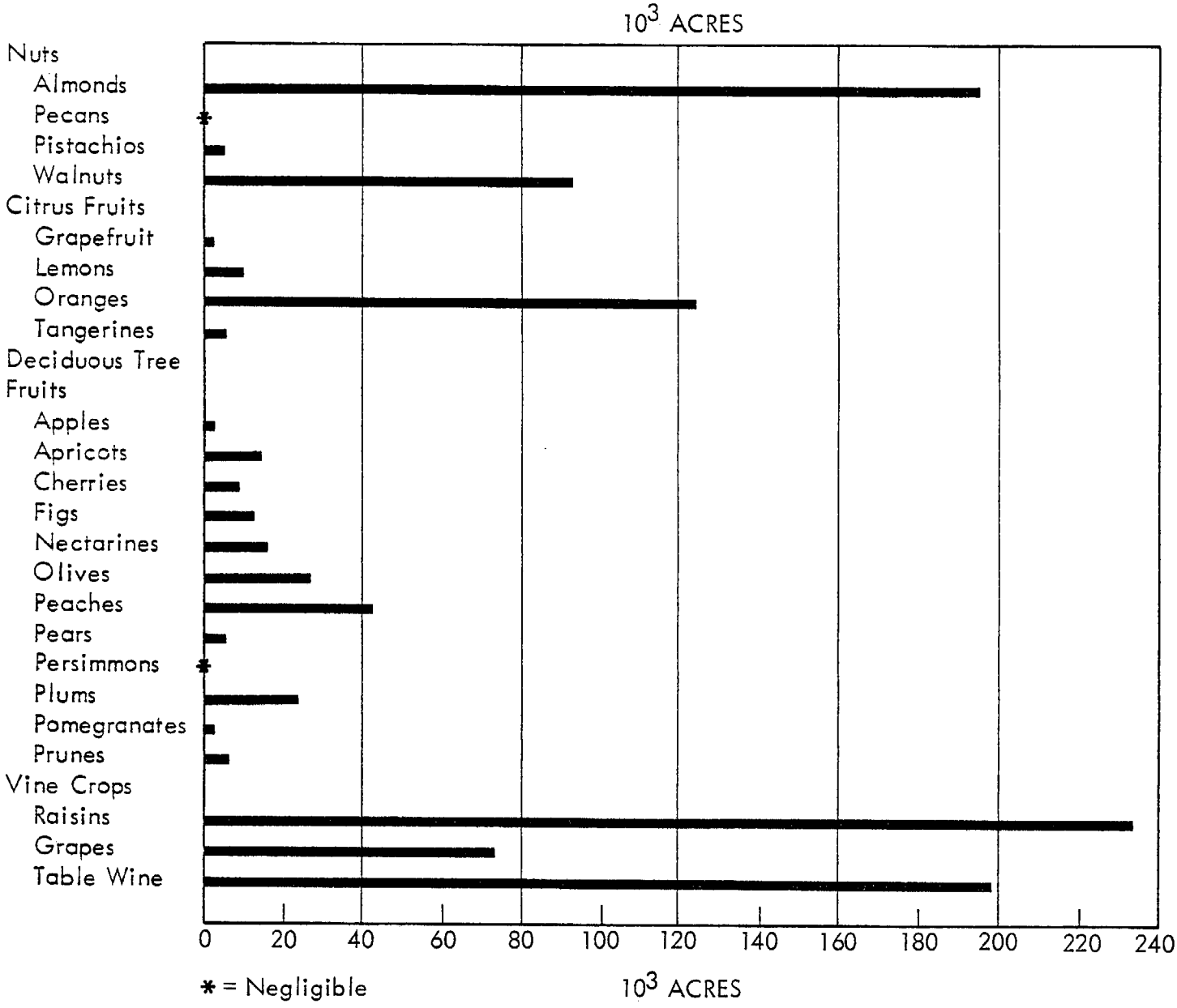
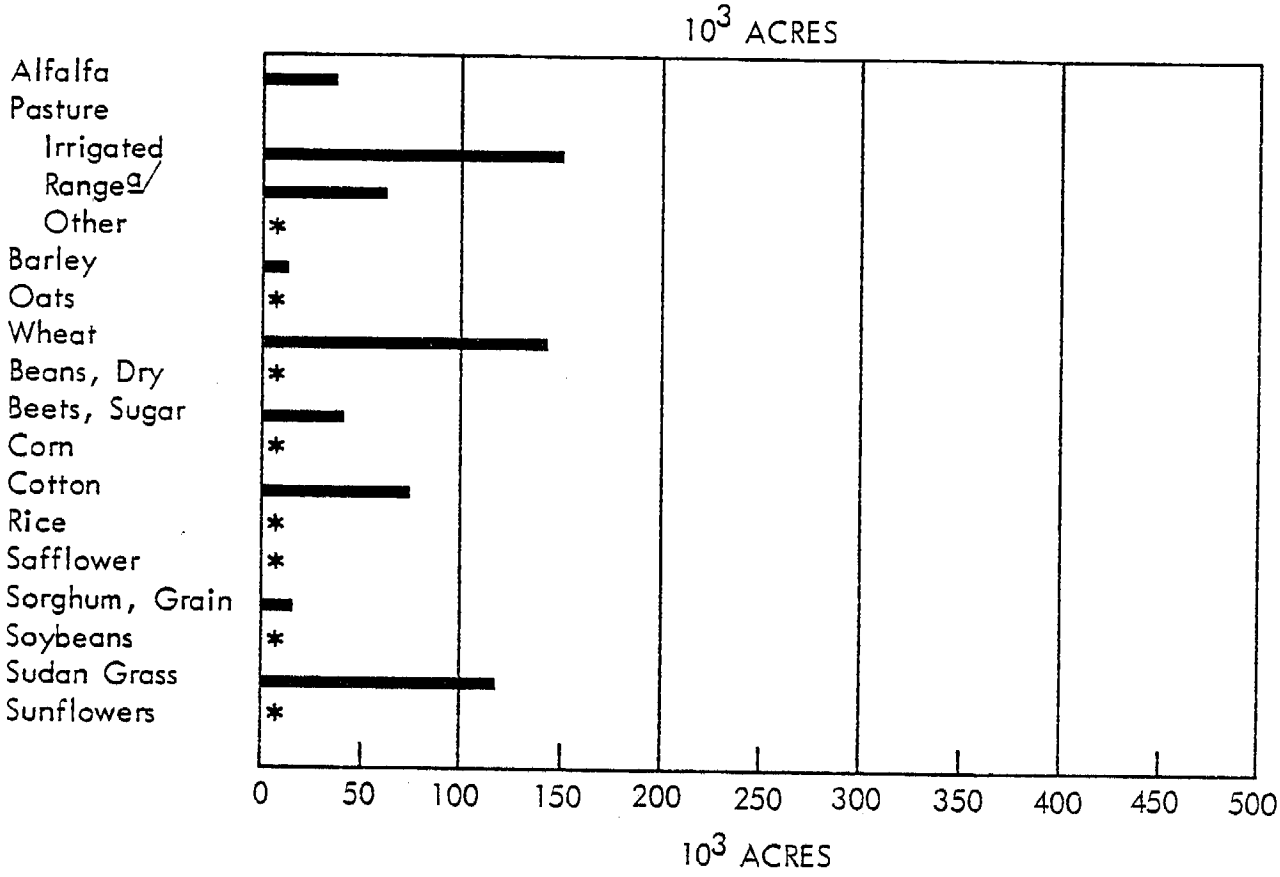


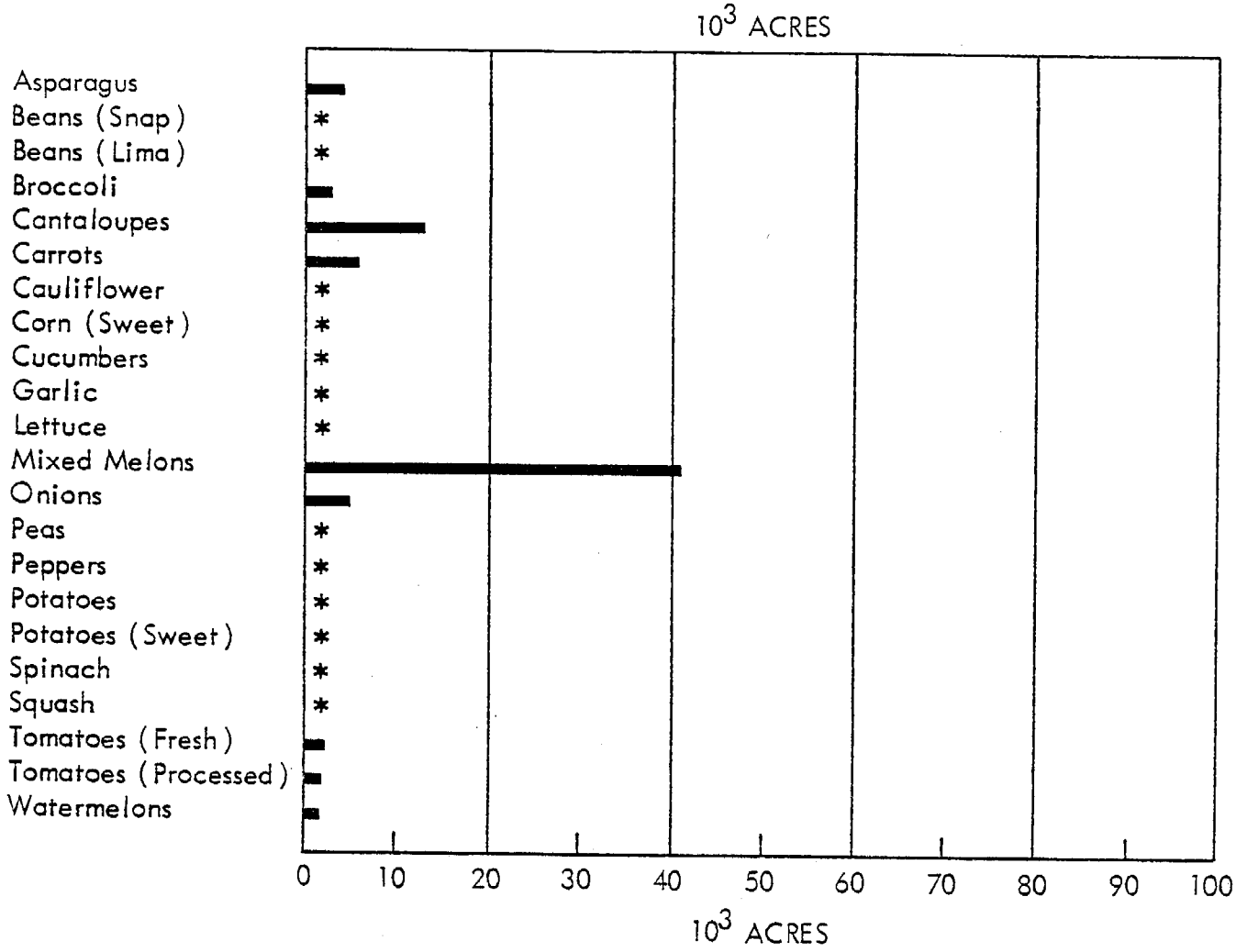
Figure 6. 1978 Acreage of harvested fruit and nut crops in the San Joaquin Valley.



* = Negligible

a/ Acreage is 10% of total range pasture land since only 10% of such land requires land preparation in each year.

Figure 7. 1978 Acreage of harvested field and seed crops in the Imperial Valley.



* = Negligible

Figure 8. 1978 Acreage of harvested vegetables in the Imperial Valley.

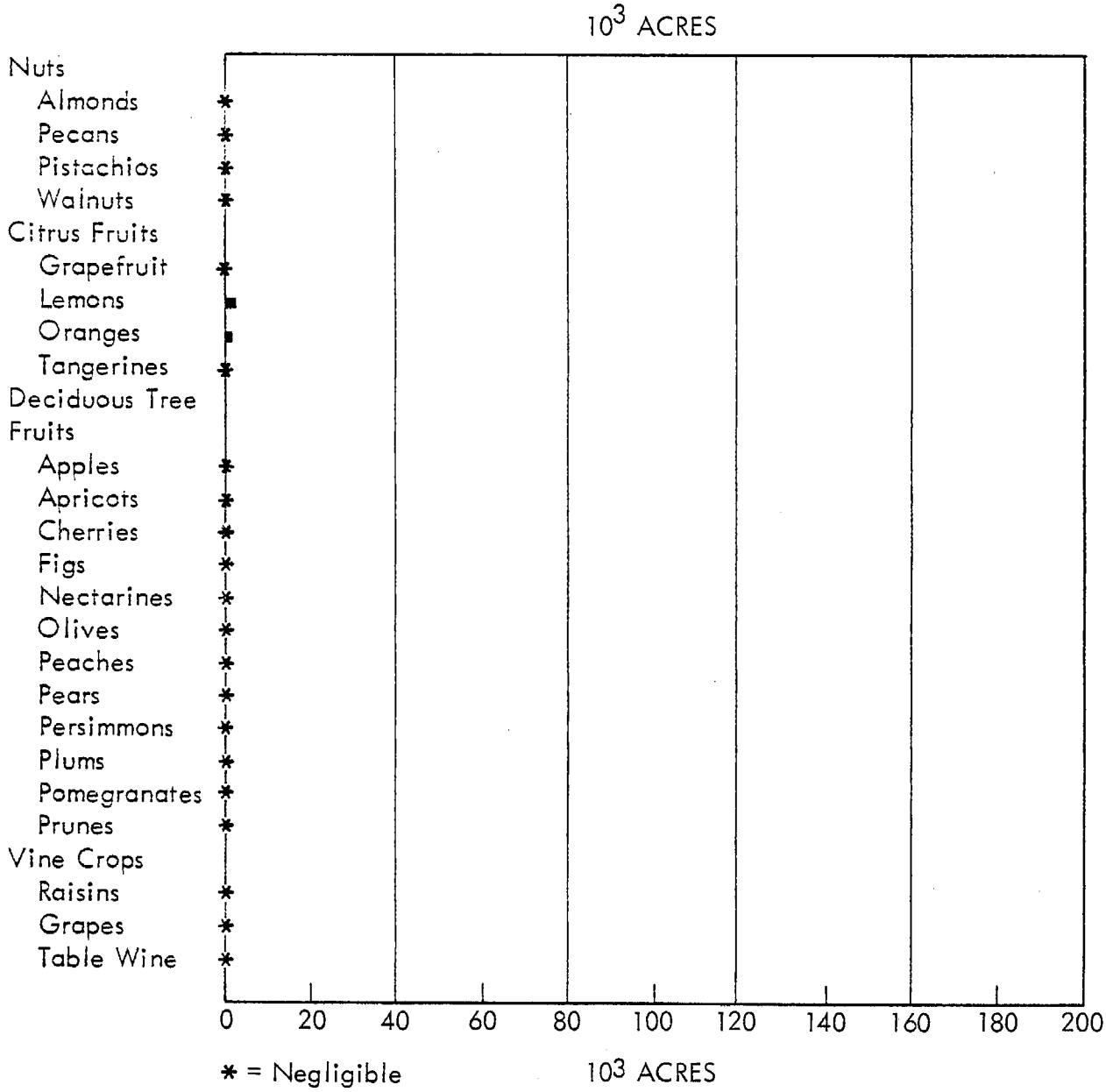


Figure 9. 1978 Acreage of harvested fruit and nut crops in the Imperial Valley.

3.0 PROJECT COST SUMMARY FOR REPORTING PERIOD

Table 1 shows dollars expended during the reporting period. Personnel costs were expended in project management functions and in the implementation of Tasks 1-3. Graphics and reproduction costs were incurred in the preparation of the last progress report. A 10% fee was charged on the subtotal to yield a total expenditure of $3,470.15 for the reporting period.

TABLE 1. LEVEL OF EFFORT EXPENDED FROM JANUARY 1 THROUGH 31, 1980

Category	Cost ($)
Personnel	1,275.96
Travel	0
Subcontractors	1,780.40
Graphic/Reproduction Services	65.87
Telephone Calls	11.95
Computer Services	0
Literature	20.50
Mailing Services	0
Fee	315.47
TOTAL	3,470.15

4.0 CUMULATIVE COST AND HOURS EXPENDED

The cumulative cost of work performed to date is $20,301.98. The cumulative hours expended to date by MRI are 384. Figure 10 shows a cumulative plot of planned and actual dollars expended.

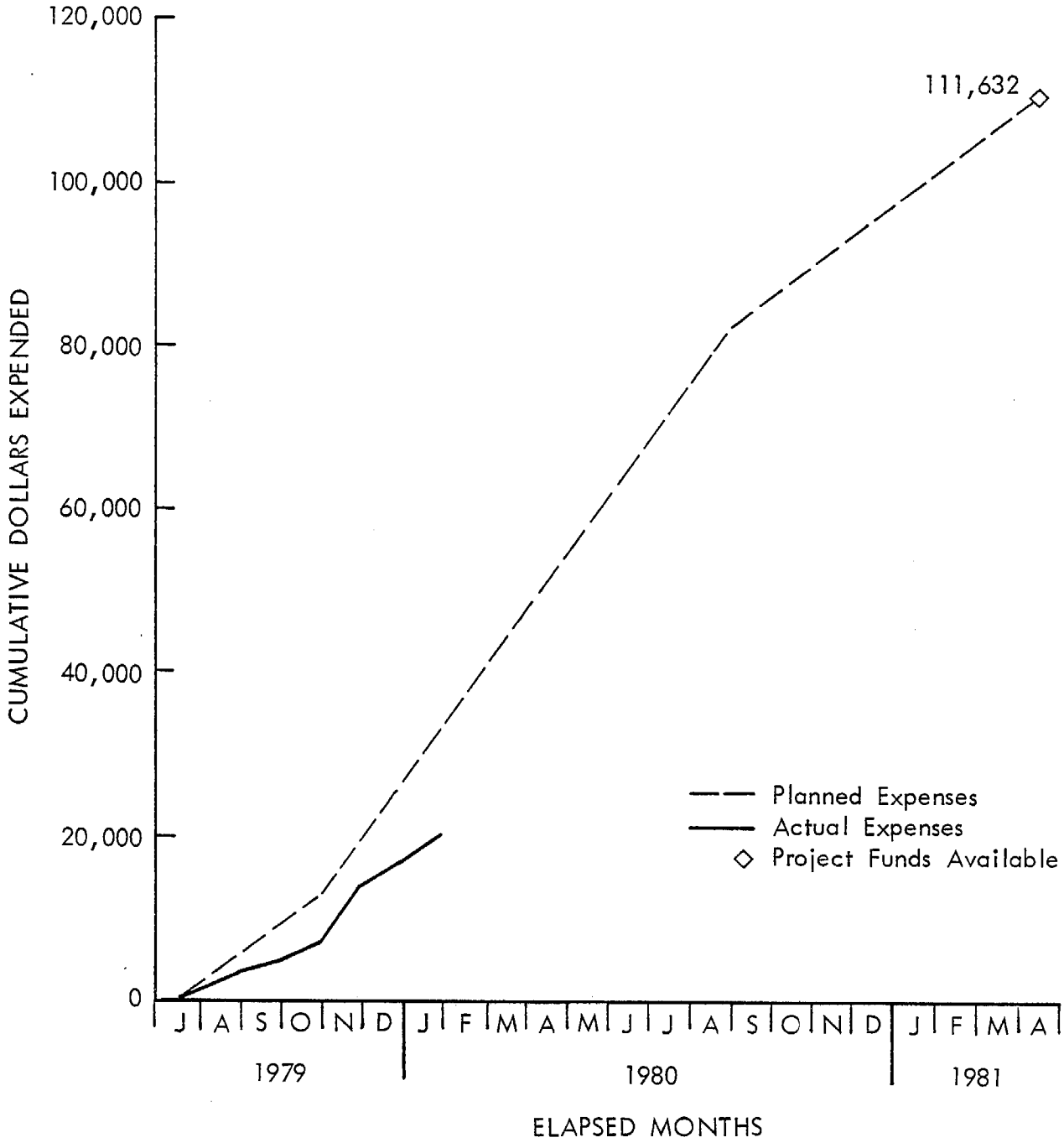


Figure 10. Cumulative dollars expended.

5.0 WORK PROPOSED FOR THE NEXT REPORTING PERIOD

The following is a list of proposed work to be completed during the next reporting period:

1. KVB will attempt to gain access to agricultural experiment stations. This will be attempted through the acquisition of an academic advisor at the University of California.

2. KVB will determine what crops will be grown at each experiment station.

3. Given the desired operations and crops to be tested (see the Appendix), KVB will specifically determine where testing of the given operations will occur.

4. MRI will estimate the monthly average surface soil moisture content for each county of concern using published data and predictive equations.

REFERENCES

1. Hatfield, J. L. Investigation Into the Prediction of Soil Moisture from Surface Measurements. Final Report for NASA-Ames Research Interchange No. NCA2-OR180-607.

2. Idso, S. B., R. D. Jackson, R. J. Reginato, B. A. Kimball, and F. S. Nakayama. The Dependence of Bare Soil Albedo on Soil Water Content. J. Appl. Meteorol. 14:109-113. 1975.

3. Idso, S. B., T. J. Schmugge, R. D. Jackson, and R. J. Reginato. The Utility of Surface Temperature Measurements for the Remote Sensing of Surface Soil Water Status. J. Geophysical Res. 80: 3044-3049. 1975.

4. Idso, S. B., R. D. Jackson, and R. J. Reginato. Compensating for Environmental Variability in the Thermal Inertia Approach to Remote Sensing of Soil Moisture. J. Appl. Meteorol. 15:811-817. 1976.

5. Jackson, R. D. Diurnal Changes in Soil Water Content During Drying. Field Soil Water Regime. Soil Science Society of America Proceedings. Special Publication No. 5. 1973.

6. Jackson, R. D., B. A. Kimball, R. J. Reginato, and F. S. Nakayama. Diurnal Soil-Water Evaporation: Time-Depth-Flux Patterns. Soil Science Society of America Proceedings. 37:505-509. 1973.

7. Reginato, R. J., S. B. Idso, J. F. Vedder, R. D. Jackson, M. B. Blanchard, and R. Goettleman. Soil Water Content and Evaporation Determined by Thermal Parameters Obtained from Ground-Based and Remote Measurements. J. Geophysical Res. 81;1617-1620. 1976.

APPENDIX

LETTER OF AUTHORIZATION TO KVB

MIDWEST RESEARCH INSTITUTE
425 Volker Boulevard
Kansas City, Missouri 64110
Telephone (816) 753-7600

January 31, 1980

Mr. R. M. Roberts
KVB, Inc.
17332 Irvine Boulevard
Tustin, CA 92680

Dear Mike:

This letter authorizes you to proceed with Task II as described in the scope of work contained in our subcontract agreement. Task II is divided into two separate subtasks: (a) make arrangements for testing, and (b) gather all existing data on surface moisture and send to Midwest Research Institute for processing.

To aid you in making the arrangements for testing, Tom Cuscino has prepared the attached list of the operations on certain crops which are prime candidates for testing. The table also gives the possible testing periods for each agricultural operation.

If it is feasible, we are planning to test during two periods of the year. Each testing period would last about two weeks. We hope to test during Period 1 in March or April. Our second 2-week period should ideally occur during Period 3 in October and early November. If arrangements cannot be made for one of these periods, then testing of operations occuring during Period 2 is an alternative.

In arranging for specific testing sites, one important criterion is that travel time from site to site be minimized. A second is flexibility in allowing for possible delay of the agricultural operation to be tested (for a day or two) until the testing personnel arrive.

A meeting with the California Air Resources Board is tentatively scheduled for mid-February (week of February 11-15) to establish what agricultural operations will be tested. One person from Midwest Research Institute along with one person from KVB and one from Meteorology Research, Inc. will attend. We are asking KVB to be prepared to identify specific sites where the operations listed on the attachment can be tested. If you recommend that testing be performed at agricultural experiment stations, the university sponsor should be identified at this meeting. The meeting

could be delayed until late February if more time were needed to arrange for testing sites.

In accomplishing the second part of Task II, please note we have established contact with Dr. Jerry Hatfield of the University of California at Davis. It is hoped that you will identify sources of surface moisture data other than those produced by Dr. Hatfield.

Finally, Bob Grant of CARB has asked why there was so little stubble burning listed in the KVB Task I report. Burning appeared only as an operation for rice. Please contact crop specialists and check this analysis. Include any additional results in your next monthly report.

If there are any questions, please call me or Tom Cuscino at 816-753-7600.

Sincerely,

MIDWEST RESEARCH INSTITUTE

Chatten Cowherd

Chatten Cowherd, Head
Air Quality Assessment Section

CC:fm

cc: T. Cuscino
R. Grant
W. Saunders

CANDIDATE AGRICULTURAL OPERATIONS FOR TESTING

Valley	Crop	Operation	Possible Testing Period	Period No.
San Joaquin	Cotton	Plow, Disc, Land Plane or List	January-April	1
		Pick	August-December	3
	Barley or Wheat	Disc, Harrow, Border, or Land Plane	September-December	3
		Combine	April-July	2
	Alfalfa	Plow, Subsoil, Disc, Land Plane or Shape Beds	February-April	1
	Corn	Stubble Disc, Land Plane, Disc, Springtooth or List	May-July	2
		Combine	September-November	3
Sacramento	Rice	Plow, Disc, or Float	February-June	1-2
	Wheat or Barley	Disc, Harrow, Border or Land Plane	September-December	3
		Combine	August-September	2-3
	Corn	Stubble Disc, Land Plane, Springtooth or List	February-June	1-2
		Combine	August-November	3
	Alfalfa	Chisel, Disc, Land Plane or Border	October-December	3